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twelve days, the younger the germ the less time should it be exposed to chromic acid. After having been in alcohol a week it is transferred to a sherry wine colored solution of bichromate of potash for a period sufficient to harden it.

With a cataract needle the investigator will then cut a trench around the embryo, cutting through the vitelline membrane, which fixes the embryo to the vitellus, and then lift it away and remove it from the latter, which, brittle and crumby, cannot be cut. The staining in a solution of carmine, as described for adult brains in this paper, will require from one to four days, according to the size of the embryo. Of each stage three series of sections are necessary, one transverse, one horizontal, and a third, the most important, sagittal, that is parallel to the median plane.

All these minutiæ, however wearisome they will prove, are necessary, and he who has thus with his scalpel, reagents and razor, constructed an open volume of natural specimens, will find himself richly rewarded by the richness in detail, the manifold character of the morphologies, and the suggestive character of the relations exposed.

The material for such a study can be obtained in a fresh state from no one locality. The student residing in New York will have to take a vacation trip to the Mississippi; he living in Chicago a corresponding trip to the Atlantic coast.

In the West he will find the great lake catfish, the lake sturgeon, the Amia calva, the gar-pike, and the remarkable spatularia, the brains of all of which should be studied. Possibly he may obtain the fresh water lamprey (Hylomyzon), but one brain which he should not neglect is that of the blind fish of the Kentucky caves, whose examination is destined to clear up somewhat the true relations of the *lobi inferiores* and the optic lobes. On the Atlantic coast all the bony fish, obtainable in the fresh waters of the West, besides a rich variety of salt water forms, also the lamprey, the shark and ray are obtainable. A trip to the Bermudas or the Florida coast, occupying about two weeks, will increase the student's *repertoire* with a host of tropical and sub-tropical genera.

WEIGHT, SPECIFIC GRAVITY, RATES OF ABSORPTION, AND CAPABILITIES OF STANDING HEAT OF VARIOUS BUILDING STONES.

By Hiram A. Cutting, Ph. D., State Geologist Vermont.

Having during the past year instituted, and carried out, a series of experiments to ascertain, as nearly as possible, the capabilities of the various materials used in the construction of so called fire proof buildings, to stand heat, I submit, in tabulated form, the result of such experiments, hoping they may be of use to the architects, quarrymen and Insurance companies of our country, and also of some interest to those interested in science.

In connection with the capabilities of the various building stones to stand fire and water, I have taken their specific gravity, and weight per cubic foot, so that the identity of the various stones could at any time be compared, and if in the working of a quarry there was a change in gravity, or weight, that it could be easily detected, and thus all who choose could know whether the tests given would apply or not.

I have procured sample specimens of the most important building stones in the United States, and Canada, and, after dressing them into as regular form as possible, three by four inches, and two inches in thickness, I have taken their ratio of absorption, which ratio I have expressed in units of weight, according to the amount of water taken up. If 450 units of stone absorbed one unit of water, I have expressed it thus: 1 + 450, meaning that the stone weighed 450 units when immersed, and 451 when taken from the water.

To accelerate the process of absorption I have placed the specimens in water under the exausted receiver of an air pump. I find that in this way as much water is absorbed in a few minutes as in days of soaking. When specimens were removed from the water, I have, before weighing, dried their outsides with blotting paper. In relation to the specific gravity, I have not followed "Gilmore's" rule in full. He weighed the specimens in air, immersed them in water, and allowed them to remain until bubbling had ceased and then weighed them in water, after which he took them from the water, dried them outside with bibulous paper, and weighed them again in air. From this last weight he subtracted the weight in water, dividing the dry weight by the difference.

This gave a specific gravity subject to two sources of error. I have followed the more frequent custom of weighing the dry stone, using pieces of two or three pounds in weight, and then immersing them in water. After the usual saturation I have taken their weight in water, subtracting it from the dry weight in air, and then dividing the dry weight by the difference. This gives the specific gravity of the rock itself, as usually found, which is what we desire, and I believe as it would generally be in buildings constructed of the given material. The specimens were previously dried by long exposure to a temperature not exceeding 200° Fah. To verify this I have taken specimens from the quarries direct, and after weighing, have brushed them over with paraffine dissolved in naphtha, weighing them again so as to ascertain the exact amount of paraffine, which made no visible change in the stone, other than to keep out water. I have then weighed in the usual way, and thus obtained the exact specific gravity of the stone as in the quarry, and I find my method used, as stated, to give the best results, and so have adopted it.

After this I have placed them in a charcoal furnace, the heat of which was shown by a standard pyrometer. In many instances I have placed them side by side with dry specimens, but have been unable to note any marked difference in the action of heat, beyond this, that the dry specimens became sooner heated, I have, however, no doubt that the capacity of a stone to absorb water is against its durability, even in warm climates, and vastly more so in the changeable and wintry climate of New England. It is here often frozen before any considerable part of the moisture from Autumn rains can be evaporated,

When the specimens were heated to 600° Fah., I have immersed them in water, also immersing others, or the same, if uninjured, at 800° and 900°, that is if they are not spoiled at less temperatures. I find that all of these samples of building stones have stood heat without damage up to 500°. At 600° a few are injured; but the injury in many cases commences at or near that point. When cooled without immersion they appear to the eye

to be injured less, but are ready to crumble, and I think they are many times nearly as much impaired, and always somewhat injured, when water produces any injury.

I would remark that my experiments with granites show that there is quite a range in their capabilities of standing heat, a range in fact much greater than I anticipated. With the sandstones the difference is also marked, as is their power of absorption. When exposed to the heat wet, they show a marked difference in the time required to heat them, the saturated ones seeming to resist the heat for a time; but when equally hot they crumble the same as those not previously saturated. Their relative worth can be seen by the table. The conglomerates stand heat badly; while the limestones and marble stand best of all (up to the point where they,by continued heat, are changed to quick lime) except soapstone, and a species of artificial stone made under the McMurtire & Chamberlain patent. The indications are, from this and other samples of artificial stone, that it may be possible to make an artificial stone cheaper and better for fire proof buildings than our native quarries furnish; and we hope this possibility may receive attention. But comments are useless, as the facts set forth in the tables speak for themselves.

I give you results in tabulated form below.

GRANITES.

No.	KIND.	LOCALITY.	Specific Gravity.	Weight of One Cubic Foot.	Ratio of Absorption.	First Appearance of Injury.	Crumbles or Cracks Slightly.	Cracks Badly or Becomes Friable.	Injured so as to be Worthless for a Building.	Melted or Ruined.
				Lbs.		Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.
1	Light colored	Hallowell, Me	2.638	164.8	1+790	800	900	950	1000	1100
2	"	Fox Island, Me	2.642	165.1	1+680	700	800	850	900	1000
3	Denning's Quarry	Mt. Desert, Me	2.631	164.1	1+716	800	850	950	1000	1100
4	Light colored	Rockford, Me	2.600	162.5	1+482	600	800	850	900	950
5	Red	Red Beach, Calais, Me	2.636	164.7	1+560	800	850	900	950	1000
6	Light colored	Oak Hill, Me	2.526	157.8	1+310	800	850	900	950	1000
7	Red	Stark, N. H	2.631	164.1	1+534	600	700	800	850	950
8	Colored medium	Concord, N. H	2.636	164.7	1+778	800	900	950	1000	1200
9	Sanborn's Quarry	Plymouth, N. H	2.649	165.5	1+685	800	900	950	1000	1200
10	Carter's Quarry	Ryegate, Vt	2.647	165.4	1+790	800	900	950	1000	1200
11	"	Woodbury, Vt	2.654	165.8	1+784	800	900	950	1000	1200
12	Wetmore & Morse's Quarry	Barre, Vt	2.651	165.6	1+720	800	900	950	1000	1200
13	Syenite	Quincy, Mass	2.660	166.2	1+650	750	800	850	900	1000
14	Gray	Croton, Conn	2.800	175.0	1+818	700	750	800	900	900
15	Common	Woodstock, Md	2.648	165.5	1+394	700	750	800	900	900
16	"	Port Deposit, Md	2.700	168.7	1+816	800	900	950	1000	1100
17	Scranton County Quarry	Richmond, Va	2.727	170.5	1+398	750	800	850	900	1000
18	Old Dominion Quarry	" "	2.674	167.7	1+402	750	800	850	900	1000
19	Light colored	St. Cloud, Minn	2.690	168.2	1+280	700	700	800	850	900
20	"	Stanstead, P. Q	2.833	177.0	1+420	800	900	1000	1000	1200
21	Coarse	North Halifax, N. S	2.698	168.6	1+584	700	800	800	900	900
22	"	Gauauogue, P. O., Can	2.687	167.9	1+736	800	850	900	950	1000

SANDSTONE.

No.	KIND.	LOCALITY.	Specific Gravity.	Weight of One Cubic Foot.	Ratio of Absorption.	First Appearance of Injury.	Crumbles or Cracks Slightly.	Cracks Badly or Becomes Friable.	Injured so as to be Worthless for a Building.	Melted or Ruined.
1	Freestone	Portland, Conn	2.380	148.7	1+ 27	850	900	950	1000	1100
2	"	North of England	2.168	135.5	1+ 27	850	900	950	950	1000
3	Seneca Stone	Montgomery Co., Md	2.500	156.2	1+ 26	850	900	900	950	950
4	Sandstone	Salem, Md	2.452	153.2	1+ 24	850	900	950	1000	1100
5	"	Seneca, Md	2.410	150.6	1+ 40	900	1000	1100	1200	1200
6	Montrose Stone	Ulster Co., N. Y	2.661	166.3	1+314	900	1000	1100	1200	1200
7	Freestone	Belleville, N. J	2.350	146.8	1+ 27	900	950	1000	1100	1100
8	"	Nova Scotia	2.424	151.5	1+240	900	950	1000	1100	1100
9	S. Carboniferous	Br. Phillipe, N. S	2.353	147.0	1+ 19	900	950	950	1000	1000
10	Freestone	Dorchester, N. B	2.363	147.7	1+ 26	800	850	900	1000	1000
11	Cincinnati Stone	Cincinnati, O	2.188	136.1	1+ 23	900	950	1000	1100	1100
12	Potsdam Sandstone	McBride's Corners, O	2.333	145.8	1+ 28	800	850	900	1000	1100
13	Berlin Stone	Cleveland, O	2.210	138.1	1+ 22	850	900	1000	1100	1100
14	Potsdam	McBride's Corners, O	2.500	156.2	1+ 22	850	900	950	1000	1000
15	Euclid Stone	Near Cleveland, O	2.290	143.1	1+ 35	850	900	950	1000	1000
16	Berea Stone	Berea, O	2.254	140.8	1+ 20	850	900	950	1000	1000
17	Amherst Stone	Amherst, O	2.200	137.5	1+ 18	850	900	changes	color.	1000
18	Brown Stone	Humbletown, Penn	2.346	146.6	1+ 28	850	900	950	1000	1000
19	Potsdam Sandstone	Beauharnois, P. Q	2.512	157.0	1+ 38	850	900	950	1000	1000
20	Sandstone	Murray Bay, P. Q	2.577	161.0	1+ 36	900	950	1000	1100	1100
21	"	Cheat River, W. Va	2.632	164.5	1+ 80	800	850	900	1000	1100
22	Freestone	Acqua Creek, Va	2.183	136.4	1+ 16	900	950	1000	1100	1200
23	Brown Stone	Manasses, Va	2.348	146.7	1+ 17	850	900	1000	1100	1200

LIMESTONE.

No.	KIND.	LOCALITY.	Specific Gravity.	Weight of One Cubic Foot.	Ratio of Absorption.	First Appearance of Injury.	Crumbles or Cracks Slightly.	Cracks Badly or Becomes Friable.	Injured so as to be Worthless for a Building.	Melted or Ruined.
1	Limestone	Baltimore, Md	2.917	181.8	1+340	900	1000	1100	1200	1200
2	"	Bedford, Ind	2.478	154.8	1+280	850	900	1000	1200	1200
3	Cincinnati Limestone	Hamilton County, O	2.204	137.7	1+ 28	850	900	950	1200	1200
4	Potts Blue	Springfield, Penn	2.666	166.6	1+280	850	850	900	1000	1200
5	Dolomite Limestone	Owen Sound P. O	2.571	160.6	1+480	850	900	1100	1200	1200
6	Trenton Limestone	Montreal, P. Q	2.706	169.1	1+316	900	950	1000	1200	1200
7	Limestone	Isle La Motte, Vt	2.636	168.5	1+320	950	1000	1100	1200	1200

CONGLOMERATES.

No.	KIND.	LOCALITY.	Specific Gravity.	Weight of One Cubic Foot.	Ratio of Absorption.	First Appearance of Injury.	Crumbles or Cracks Slightly.	Cracks Badly or Becomes Friable.	Injured so as to be Worthless for a Building.	Melted or Ruined.
1	Conglomerate	Roxbury, Mass	2.708	169.2	1+49	700	800	900	1000	1000
2	Potomac Stone	Point of Rocks, Md	2.724	170.2	1+60	600	700	800	900	900
3	Conglomerate	Cape a La Aisle, P. Q	2.645	165.3	1+80	600	700	800	900	900

MARBLES.

No.	KIND.	LOCALITY.	Specific Gravity.	Weight of One Cubic Foot.	Ratio of Absorption.	First Appearance of Injury.	Crumbles or Cracks Slightly.	Cracks Badly or Becomes Friable.	Injured so as to be Worthless for a Building.	Melted or Ruined.
						Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.
1	Tuckahoe	Westchester Co., N. Y.	2.794	194.6	1+298	900	1000	1200	1200	1200
2	Ashley Falls	Ashley Falls, N. Y.	2.742	171.3	1+280	900	1000	1100	1200	1200
3	Snow Flake	Westchester Co., N. Y.	2.848	178.0	1+380	950	950	1000	1200	1200
4	Tennessee	Dougherty's Q'y, E. Tenn	2.711	169.4	1+320	950	950	1000	1200	1200
5	Duke Marble	Near Harper's Ferry, Va.	2.812	175.7	1+340	1000	1000	1100	1200	1200
6	Black Marble	Isle La Motte, Vt	2.682	176.6	1+320	1000	1000	1100	1200	1200
7	Sutherland Falls	Rutland, Vt	2 666	166.6	1+342	1000	1000	1100	1200	1200

SLATES.

1	Sabin's Quarry	Montpelier, Vt	2.869	179.3	1+110	800	850	900	1000	1200

SOAPSTONES.

1	Soapstone	Weathersfield, Vt	2.668	166.7	1+3 8	1200	----	----	----	----

ARTIFICIAL STONE.

1	Artificial Stone	McMurtire & Chamberlain's patent	2.235	139.7	1+280	750	800	1100	1200	----

MINERAL WAX, A RESUMÉ.

By M. BENJAMIN, PH. B.

Geographical Distribution. Mineral wax or ozocerite (from ὄζειν, to smell, and κηρος, wax) is found in a sandstone in Moldavia, in the vicinity of coal and rock salt. It also occurs in large quantities at Borislav, near Drohobycz, and at Dzwiniacz, near Stainstawow in Galicia, a province of Austria. The mines are situated at the northern foot of the Carpathian Mountains. It has also been found at several other places in the same province. Small quantities have been discovered in England, at Binney Quarry, Linlithgowshire; at the Urpeth Colliery, Newcastle-on-Tyne, and in Wales. In this country it has been found in Texas, in Utah and in California, about fifty miles northeast of Los Angelos, among the Sierra Madre Mountains In Utah the mineral occurs in shale beds, out of which the ozocerite appears as exudations. These shale beds are quite extensive—some forty to sixty miles long by twenty wide, and from seventy to forty feet in thickness. It is thought that by digging and boring the supply of the wax may be increased.

Geologically it is presumed that these beds were formed in a tertiary lake or peat bog. Prof. J. S. Newberry suspects that it will be found to be an evolved product, the distillation of beds of cretaceous lignite and the residue of a petroleum unusually rich in paraffine. The foreign deposits are considered to be about of the same age.

Mode of Occurrence. It is generally found (referring to Galacia) in thin layers and small pieces which must separated from the matrix in which they are found. The smallest pieces are only obtained by a process of washing. It is sometimes found in lumps or layers from one to three feet in thickness, a lump sometimes weighing several hundred weght.

Physical Properties. It is like a resinous wax in consistency and translucency, sometimes with a foliated structure. Its color is brown or brownish yellow by transmitted light and leek green by reflected light. The poorer qualities, which are colored black and are either too soft from abundance of petroleum or too hard (asphalt like in character), are mainly used for the production of paraffin. It possesses a pleasantly aromatic odor. The American variety is described as black in the mass, sections of which are translucent.

Its Chemical Nature. The specific gravity of ozocerite is 0.94 to 0.97. According to Dana it ranges from 0.85 to 0.90.

Its melting point is variously given as follows:

The Moldavian,	84°	Malaguti.
Urpeth mineral,	60°	Johnson.
Galacian,	60°	Höfstadter.
Utah,	61°5	Newberry.
Moldavian,	62°	Schrötter.
From Slanik,	62°	Glocker.
Galacian,	63°	Wagner.

The boiling point is likewise differently given by the authorities:

Urpeth mineral,	121°	Johnson.
Moldavian,	210°	Schrötter.
Moldavian,	300°	Malaguti.
Utah, between	300° and 380°	Newberry.

Concerning this last determination, Dr. S. B. Newberry says; 1.5 grammes of the substance were treated with about 300 c. c. of cold ether, and allowed to stand for twenty-four hours. The substance was decanted through a filter, evaporated, and the resulting mineral tested to obtain the melting point. This treatment gave me a fraction equal to 25.4 per cent. of the original substance, and having a melting point of 49.° C. The residue was again treated with 200 c. c. of cold ether for about the same time, and gave a further product equal to 9.1 per cent. of the original mass, fusing at 61°. On boiling the undissolved portion in about 500 c. c. of ether the whole mass went into solution, and upon evaporation was found to have a fusing point of 67°. It distills without decomposition, is not altered by strong acids, and very little by hot alcohol. The Moldavian variety dissolves but slightly in ether, whereas that found at Urpeth dissolves in this medium to the amount of four-fifths, and separates on evaporation in brown flecks, which melt at 38.°9 to a yellowish brown liquid. The solubility of the variety found in Utah has been sufficiently referred to in the remarks on its fusing point. The composition of ozocerite has been found to be: